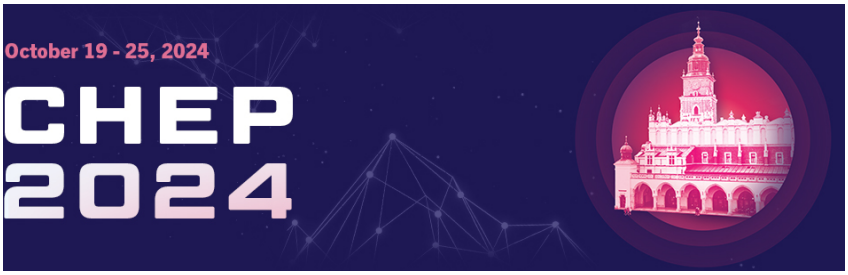

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Real-time Level-1 Trigger Data Scouting at CMS using CXL Memory Lake

Thursday 24 October 2024 16:00 (15 minutes)

Level-1 Data Scouting (L1DS) is a novel data acquisition subsystem at the CMS Level-1 Trigger (L1T) that exposes the L1T event selection data primitives for online processing at the LHC's 40 MHz bunch-crossing rate, enabling unbiased and unconventional analyses. An L1DS demonstrator has been operating since Run 3, relying on a ramdisk for ephemeral storage of incoming and intermediate data, accessible by the system's units through NFS. With the HL-LHC and CMS'Phase 2 upgrade projected to enhance trigger resolutions, a high-performance shared memory system is key to retain real-time processing capabilities in Run 4. For this, we leverage the emerging Compute Express Link (CXL) open standard, which provides uniform, cache-coherent memory access from heterogeneous processing units, targeting a streamlined pipeline with minimized data movement over a memory lake shared among CPUs and GPUs. In this contribution, we present the integration of CXL-compliant shared memory into the L1DS demonstrator at CMS, including an overview of our approach's design, benefits, and limitations. Furthermore, we evaluate CXL-based L1DS performance through analyses in heterogeneous contexts, supporting a discussion of the memory lake model and its use cases for the CMS community.

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